WATER MANAGEMENT, EROSION AND
SEDIMENT CONTROL FOR CONSTRUCTION AREAS

TECHNICAL STANDARD AND SPECIFICATIONS

## Temporary Sediment Basin (SB)

### Definition

A temporary barrier or dam constructed across a watercourse or at other suitable locations to retain sediment and other waterborne debris.

### Scope

This standard establishes minimum acceptable criteria for the design and construction of temporary sediment basins formed by an embankment, excavation, or a combination of embankment and excavation. This standard is limited to sites where:

1. Failure of the structure would not result in loss of life; damage to homes; commercial, or industrial buildings; damage to highways or railroads, or interruption of use or service or private utilities (hazard class "A" only).

2. The height of dam is 25 feet or less, as measured from the natural streambed at the downstream toe of dam to the top of dam.

3. The product of the total volume of storage (AC-Ft) and the height of dam (Ft) is not greater than 3,000.

4. The drainage area is 100 acres or less. -

5. The basin will be removed within a three-year period after construction.

### Purpose

Temporary sediment basins are used as a means of trapping and storing sediment from eroding areas in order to protect downstream areas from damage resulting from sedimentation and waterborne debris.

### Conditions Where Practice Applies

Temporary sediment basins apply where physical site conditions or other restrictions preclude the installation of erosion control measures to adequately control erosion and sedimentation. It may be used downslope from construction operations that expose areas to erosion. Temporary sediment basins will be removed after the exposed areas are adequately protected against erosion by vegetative or mechanical means.

**Temporary Sediment Basin (SB) (Cont'd)**

## Compliance with Laws and Regulations

Unless otherwise excepted, all dams with a height of 25 feet or more or storage of 50 Ac-Ft or more require a construction permit prior to the start of construction. Construction permits are obtained from the Division of Water, Department for Environmental Protection. The height of the dam is measured from the natural streambed at the downstream toe of dam to the top of dam.

Design and construction shall comply with all federal, state and local laws, ordinances, rules and regulations.

## Planning Considerations

### Effectiveness

Sediment basins are typically only 70-80 percent effective in trapping sediment that flows into them. Therefore, they should be used in conjunction with erosion control practices such as temporary seeding, mulching, diversion dikes, etc., to reduce the amount of sediment flowing into the basin.

### Location

To improve the effectiveness of the basin, it should be located so as to intercept the largest possible amount of runoff from the disturbed area. The best locations are generally low areas and natural drainageways below disturbed areas. Drainage into the basin can be improved by the use of stabilized diversion dikes and ditches. The basin must not be located in a live stream but should be located to trap sediment-laden runoff before it enters the stream. The basin should not be located where its failure would result in the loss of life or interruption of the use or service of public utilities or roads.

### Multiple Use

Sediment basins may be designed as permanent structures to remain in place after construction is completed. Site conditions may make the use of these structures desirable for stormwater detention purposes. Wherever these structures are to become permanent, or if they exceed the size limitations of the design criteria, they must be designed as permanent ponds by a qualified professional engineer. Permanent ponds are beyond the scope of these standards and specifications.

**Temporary Sediment Basin (SB) (Cont'd)**

## Design Criteria for Temporary Sediment Basins

### Sediment Volume

The minimum capacity of the sediment basin to the elevation of the crest of the pipe spillway shall be 1,800 cubic feet (0.04 acre-feet) for each acre within the drainage area that will be disturbed by construction during the designed life of the sediment basin. If other areas within the drainage area are actively eroding, additional sediment capacity must be added (volume will be determined based on site conditions).

Sediment basins will be cleaned out to their designed capacity when sediment retained in the basins has reduced its capacity to 60 percent of the designed volume.

Basin dimensions necessary to determine the designed sediment volume shall be clearly shown on the plans to facilitate plan review, construction, operation and maintenance.

### Shape of Basin

The basin configuration shall be such that the effective flow length through the basin is at least two times the average width of the basin. Baffles will be used when necessary to prevent short circuiting.

### Classes of Sediment Basins

**TABLE 1**

| Class | Drainage Area (acres) | Maximum Height* of Embankment (feet) | Pipe Spillway Required | Design Emergency Spillway | Storm Frequency |
|---|---|---|---|---|---|
| 1 | 20 | 5 | Yes | No | 10 Yrs. |
| 2 | 20 | 25 | Yes | Yes | 10 Yrs. |
| 3 | 100 | 25 | Yes | Yes | 25 Yrs. |

*Height is measured from the low point of original ground at the downstream toe of dam to the top of the dam.

**Temporary Sediment Basin (SB) (Cont'd)**

Pipe Spillway Design

Runoff shall be computed by the method outlined in Chapter 2, Engineering Field Manual for Conservation Practices, SCS, or by other acceptable methods. Runoff computations shall be based upon soil cover conditions of the contributing drainage area during the design life of the structure.

For Class 1 dams, the capacity of the pipe spillway will be sufficient to pass the runoff of a 10-year frequency 24-hour duration storm. For Class 2 and Class 3 dams the capacity of the spillway will be sufficient to pass the runoff of a 2-year frequency 24-hour duration storm. In all cases, the minimum diameter of the conduit shall be 8 inches. Pipes may be designed by using (1) Peak runoff of the design storm or (2) Flood-routing the design storm using acceptable procedures.

a. Crest Elevation - The crest elevation of the riser or hood inlet shall be at the elevation of the designed sediment volume.

b. Riser - Non-perforated risers shall be completely watertight except for the inlet opening at the top. Manufactured stubs or knockout plugs for dewatering the basin may be used. The riser shall have a cross-sectional area of at least 1.3 times that of the pipe barrel. Risers may be located in the sediment pool or in the upstream slope of the embankment.

   Perforated risers are not recommended because of their adverse effect on the trap efficiency of the basin. However, if it is necessary to use a perforated riser, the pipe will be perforated with 1/2 inch diameter holes spaced 8 inches vertically and 10 to 12 inches horizontally.

c. Antivortex Device - An antivortex device shall be installed at and firmly attached to the top of the riser. The antivortex device should be a vertical steel plate and installed parallel with the pipe barrel; minimum length = riser diameter + 12 inches; minimum height + pipe barrel diameter or 12 inches, thatever is greater.

   For hooded inlets, an antivortex device shall also be installed.

**Temporary Sediment Basin (SB) (Cont'd)**

d. Trash Rack - Trash racks are recommended for all principal spillways. However, they are required when the basin is located in a wooded drainage area or subject to floating debris, or where the riser will create a safety problem.

e. Riser Base - The riser shall have a watertight base and shall have sufficient weight to prevent flotation of the riser.

The minimum factor of safety against flotation shall be 1.1. Where concrete is used for the riser base, the following formula may be used in calculating the required volume of concrete:

$$V = 0.62HD^2 - \frac{HW^R}{87.6}$$

Where: H = Height Riser (ft)
D = Diameter Riser (ft)
$W_R$ = Weight Riser (lb/ft)
V = Volume of Concrete ($ft^3$)

f. Anti-Seep Collars - Anti-seep collars will be installed around the pipe barrel for all installations where the height of earthfill over the top of pipe is 5 feet or greater. The combination of the number of collars and the collar projections must increase the length of the line of seepage by at least 15 percent.

Select the desired number of collars and solve for the minimum projection:

$$V = 0.075\ L/N$$

or

Select the collar projection and solve for the minimum number of collars.

$$N = 0.075\ L/V$$

Where: V = Collar projection in feet
N = Number of collars
L = Length of pipe within embankment

Where more than one collar is used, they shall be spaced approximately 25 feet apart.

**Temporary Sediment Basin (SB) (Cont'd)**

g. Outlet Protection - The pipe barrel shall outlet at approximately the lowest elevation of the valley cross section at the downstream toe of the dam. Protection using rock riprap, paving or other acceptable materials will be used to convey pipe discharge to a stable watercourse in an erosion free manner.

Emergency Spillway

For Class 1 sediment basins, the embankment will be used as an emergency spillway, and the downstream slope shall be 5:1 or flatter. Also, the downstream slope must be immediately protected with vegetation, rock riprap or other acceptable materials.

Emergency spillways shall be constructed for all Class 2 and 3 sediment basins. The spillway cross section shall be trapezoidal with a minimum bottom width of 8 feet and steepest sideslopes of 2:1.

1. Crest Elevation - The crest of the emergency spillway will be set at the elevation required to pass the 2-year frequency 24-hour duration storm through the pipe spillway. In no case shall the difference in elevation between the crests of the pipe spillway and the emergency spillway be less than 1.0 foot.

2. Capacity - The minimum capacity of the emergency spillway shall be that required to pass the peak-rate of runoff from the design storm (see Table 1), minus the capacity of the pipe spillway. Emergency spillway dimensions can be determined using charts in Chapter 11, Engineering Field Manual, SCS.

3. Velocities - The maximum allowable velocity of flow in the exit section of vegetated emergency spillways shall be 6 feet per second. For spillways with erosion protection other than vegetation, velocities shall be in the safe range for the type of protection used.

4. Control Section - The spillway shall have a control section at least 20 feet in length. The control section is a level portion of the spillway channel at the highest elevation in the channel.

**Temporary Sediment Basin (SB) (Cont'd)**

Freeboard

For Class 2 and 3 basins, the freeboard is the difference in elevation between the flow elevation (Hp) of the emergency spillway and the top of the settled embankment. For Class 1 basins, the freeboard is the difference in elevation between the stage required to pass the design storm through the pipe spillway and the top of the settled embankment. In all cases, the minimum freeboard shall be 1.0 foot.

Location

The emergency spillway channel shall be located so that it will not be constructed over fill material. The channel shall be located so there are no sharp turns or bends. The channel shall return the flow of water to a defined channel downstream from the embankment.

Embankment (Earthfill)

For Class 1 basins, the minimum top width shall be 10 feet; the upstream slope shall be no steeper than 2:1 and the downstream slope shall be no steeper than 5:1.

For Class 2 and 3 basins, the minimum top width shall be 10 feet, and the side slopes shall be no steeper than 2-1/2:1.

An allowance for settlement of at least 10 pereent will be added to the design height of the embankment.

Disposal

Cleanout - Sediment shall be removed from the basin when the capacity is reduced to 60 percent of the design volume. Plans for the sediment basin shall indicate the methods for disposing of sediment removed from the basin. Possible alternatives are the use of the material in fill areas on-site or removal to an approved off-site dump.

Final Removal - Sediment basin plans shall indicate the final disposition of the sediment basin after the upstream drainage area is stabilized. The plans shall indicate methods for the removal of excess water lying over the sediment, stabilization of the basin site, and the disposal of any excess material.

**Temporary Sediment Basin (SB) (Cont'd)**

Vegetative Protection

Vegetation will be established upon completion of construction of the embankment, emergency spillway and other areas disturbed by construction.

Safety

Where sediment basins are accessible to the public, they shall be fenced and posted. All additional health and safety measures required by local ordinance will be installed.

SPECIFICATIONS

Embankment Basins

The foundation area shall be cleared of all trees, stumps, roots, and brush boulders, sod, and debris. All channel banks and sharp breaks shall be sloped to no steeper than 1:1. All topsoil containing excessive amounts of organic matter shall be removed. The surface of the foundation area will be thoroughly scarified before placement of the embankment material.

The cutoff trench shall be excavated to the lines and grades shown on the plans or as changed during construction because of site conditions, and shall be backfilled with suitable material in the same manner as specified for earth embankment. The trench shall be kept free of standing water during backfill operations.

Existing stream channels crossing the foundation area shall be sloped no steeper than 1:1 and deepened and widened as necessary to remove all stones, gravel, sand, roots, and other objectionable material and to accommodate compacting equipment. Such channels shall then be backfilled with suitable material as specified for each embankment.

The pipe conduit barrel shall be placed on a firm foundation to the lines and grades shown on the plans. Selected backfill material shall be placed around the conduit in layers, and each layer shall be compacted to at least the same density as the adjacent embankment. All compaction within (2) feet of the pipe spillway will be accomplished with hand-operated tamping equipment.

**Temporary Sediment Basin (SB) (Cont'd)**

The complete spillway excavation shall conform to the lines, grades, bottom width, and side slopes shown on the plans.

All borrow areas outside the pool and in the drainage area shall be graded and left in such a manner that water will not be ponded.

The material placed in the fill shall be free of all sod, roots, frozen soil, stones more than 6 inches in diameter, and other objectionable material. The placing and spreading of the fill material shall be brought up in approximately 6-inch horizontal layers or of such thickness that the required compaction can be obtained with the equipment used. Construction equipment shall be operated over the area of each layer in a way that will result in the required compaction.

Special equipment shall be used when the required compaction cannot be obtained without it.

The distribution and gradation of materials throughout the fill shall be such that there will be no lenses, pockets, streaks, or layers of material differing substantially in texture or gradation from the surrounding material. Where it is necessary to use materials of varying texture and gradation, the more impervious material shall be placed in the upstream and center portions of the fill.

The moisture content of fill material shall be such that the required degree of compaction can be obtained with the equipment used.

Fill shall not be placed on frozen, slick or saturated soil.

The topsoil material saved in the site preparation shall be placed as a top dressing on the surface of the emergency spillways, embankments, and borrow areas. It shall be evenly spread to a thickness as specified on the plans.

A protective cover of herbaceous vegetation shall be established on all exposed surfaces of the embankment, spillway, and borrow areas to the extent practical under prevailing soil and climatic conditions.

Seedbed preparation, seeding, fertilizing, and mulching shall comply with the local SCS Technical Guide.

**Temporary Sediment Basin (SB) (Cont'd)**

Excavated Basins

The completed excavation shall conform to the lines, grades and elevation shown on the plans.

The material excavated from the basin shall be placed in one of the following ways so that its weight will not endanger the stability of the side slopes and where it will not be washed back into the basin by rainfall:

1. Uniformly spread to a height not exceeding 3 feet with the top graded to a continuous slope away from the basins.

2. Uniformly placed or shaped reasonably well with side slopes assuming the natural angle or repose for the excavated material behind a berm width equal to the depth of the basin, but not less than 12 feet.

WATER MANAGEMENT, EROSION AND
SEDIMENT CONTROL FOR CONSTRUCTION AREAS

TECHNICAL STANDARD AND SPECIFICATIONS

**Straw Bale Barrier (SBB)**

Definition

A temporary barrier to trap sediment consisting of a row of entrenched and anchored straw bales.

Purposes

1. To intercept and detain small amounts of sediment from disturbed areas of limited extent and/or sinkholes in order to prevent sediment from leaving the site.

2. To decrease the velocity of sheet flows and low-to-moderate level channel flows.

Conditions Where Practice Applies

1. Below disturbed areas subject to sheet and rill erosion.

2. Where the size of the drainage area is no greater than 1/4 acre per 100 feet of barrier length; the maximum slope length behind the barrier is 100 feet; and the maximum slope gradient behind the barrier is 50 percent (2:1).

3. In minor swales or ditch lines where the maximum contributing drainage area is no greater than 2 acres.

4. Where effectiveness is required for less than 3 months.

5. Under no circumstances should straw bale barriers be constructed in live streams or in swales where there is the possibility of a washout.

Planning Considerations

Based on observations, straw bale barriers have not been as effective as some users had hoped they would be. Laboratory work at Virginia Highway and Transportation Research Council (VH&TRC) has shown that silt fences can trap a much higher percentage of suspended sediments than can straw bales. There are three major reasons for such ineffectiveness.

Improper use of straw bale barriers has been a major problem. Straw bale barriers have been used in streams and drainageways where high water velocities and volumes have destroyed or impaired their effectiveness.

**Straw Bale Barrier (SBB) (Cont'd)**

Improper placement and installation of the barriers, such as staking the bales directly to the ground with no soil seal or entrenchment, has allowed undercutting and end flow. This has resulted in additions of rather than removal of sediment from runoff waters. Inadequate maintenance lowers the effectiveness of these barriers. Trapping efficiencies of carefully installed straw bale barriers on one project dropped from 57 percent to 16 percent in one month due to lack of maintenance.

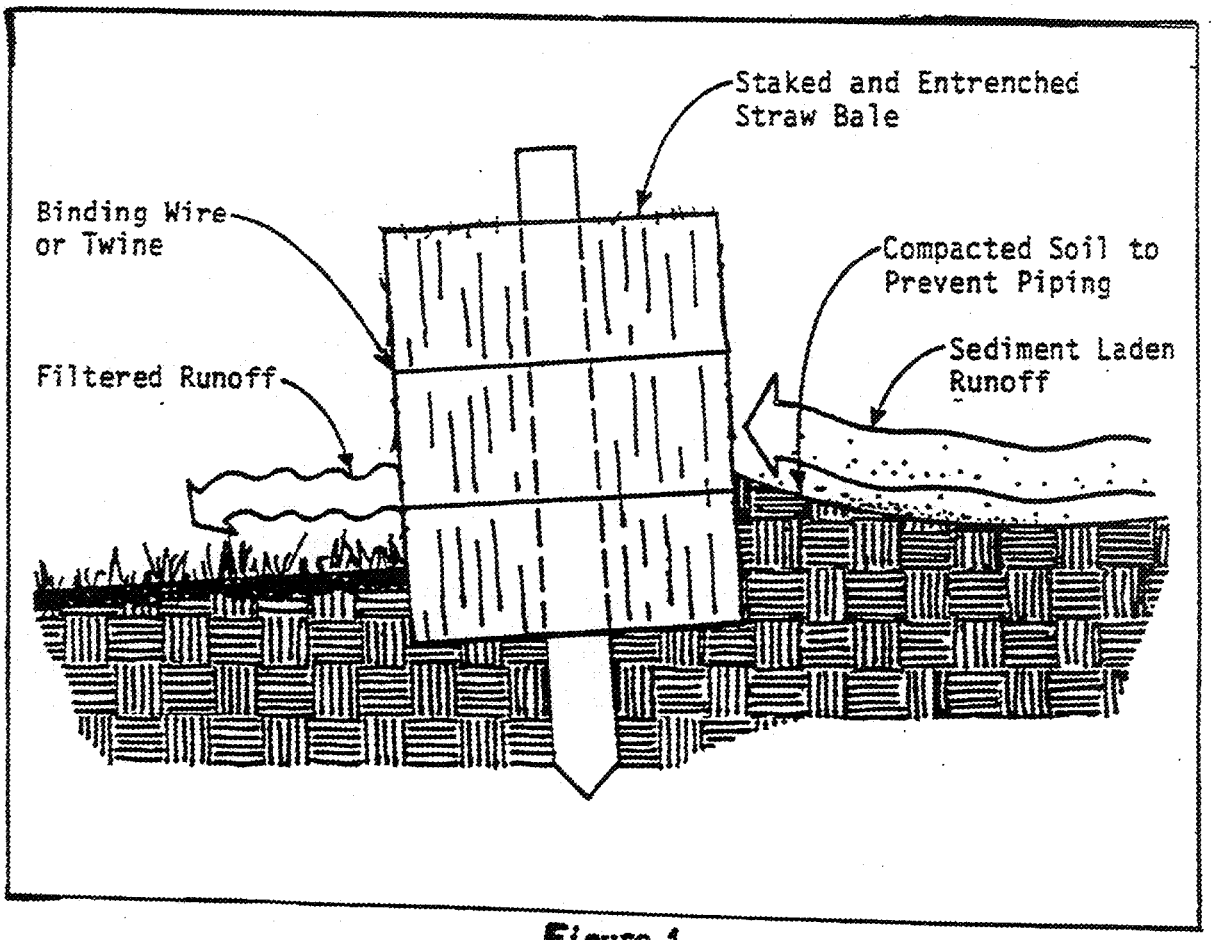



**Figure 1**

CROSS-SECTION OF A PROPERLY INSTALLED STRAW BALE

**Straw Bale Barrier (SBB) (Cont'd)**

There are questions about the continued use of straw bale barriers as they are presently installed and maintained. Averaging approximately $4 per linear foot, the thousands of straw bale barriers used annually represent sufficient expense that optimum installation procedures should be followed. If such procedures are carefully followed, straw bale barriers can be quite effective. Continued use of straw bale barriers may be contingent upon the installation and maintenance procedures applied to their use.

Design Criteria

A formal design is not required.

SPECIFICATIONS

The following construction specifications have been adapted from the Virginia Erosion and Sediment Control Handbook.

Sheet Flow Applications

1. Bales shall be placed in a single row, lengthwise on the contour, with both ends of adjacent bales tightly abutting one another.

2. All bales shall be either wire-bound or string-tied. Straw bales shall be installed so that bindings are oriented around the sides rather than along the tops and bottoms of the bales (in order to prevent deterioration of the bindings). See Figure 1.

3. The barrier shall be entrenched and backfilled. A trench shall be excavated the width of a bale and the length of the proposed barrier to a minimum depth of 4 inches. After the bales are staked and chinked, the excavated soil shall be backfilled against the barrier. Backfill soil shall conform to the ground level on the downhill side and shall be built up to 4 inches against the uphill side of the barrier (Figure 2).

4. Each bale shall be securely anchored by at least two stakes or rebars driven through the bale. The first stake in each bale shall be driven toward the previously laid bale to force the bales together. Stakes or rebars shall be driven deep enough into the ground to securely anchor the bales.

**Straw Bale Barrier (SBB) (Cont'd)**

5. The gaps between bales shall be chinked (filled by wedging) with straw to prevent water from escaping between the bales. (Loose straw scattered over the area immediately uphill around a straw bale barrier tends to increase barrier efficiency.)

6. Inspection shall be frequent, and repair or replacement shall be made promptly as needed.

7. Straw bale barriers shall be removed when they have served their usefulness, but not before the upslope areas have been permanently stabilized.

Channel Flow Applications

1. Bales shall be placed in a single row, lengthwise, oriented perpendicular to the contour, with ends of adjacent bales tightly abutting one another.

2. The remaining steps for installing a straw bale barrier for sheet flow applications apply here, with the following addition.

3. The barrier shall be extended to such a length that the bottoms of the end bales are higher in elevation than the top of the lowest middle bale (Figure 3) to assure that sediment-laden runoff will flow either through or over the barrier, but not around it.

Maintenance

1. Straw bale barriers shall be inspected immediately after each rainfall and at least daily during prolonged rainfall.

2. Close attention shall be paid to the repair of damaged bales, end runs and undercutting beneath bales.

3. Necessary repairs to barriers to replace bales shall be accomplished promptly.

4. Sediment deposits should be removed after each rainfall. They must be removed when the level of deposition reaches approximately one-half the height of the barrier.

5. Any sediment deposits remaining in place after the straw bale barrier is no longer required, shall be dressed to conform to the existing grade, prepared and seeded.

**Straw Bale Barrier (SBB) (Cont'd)**

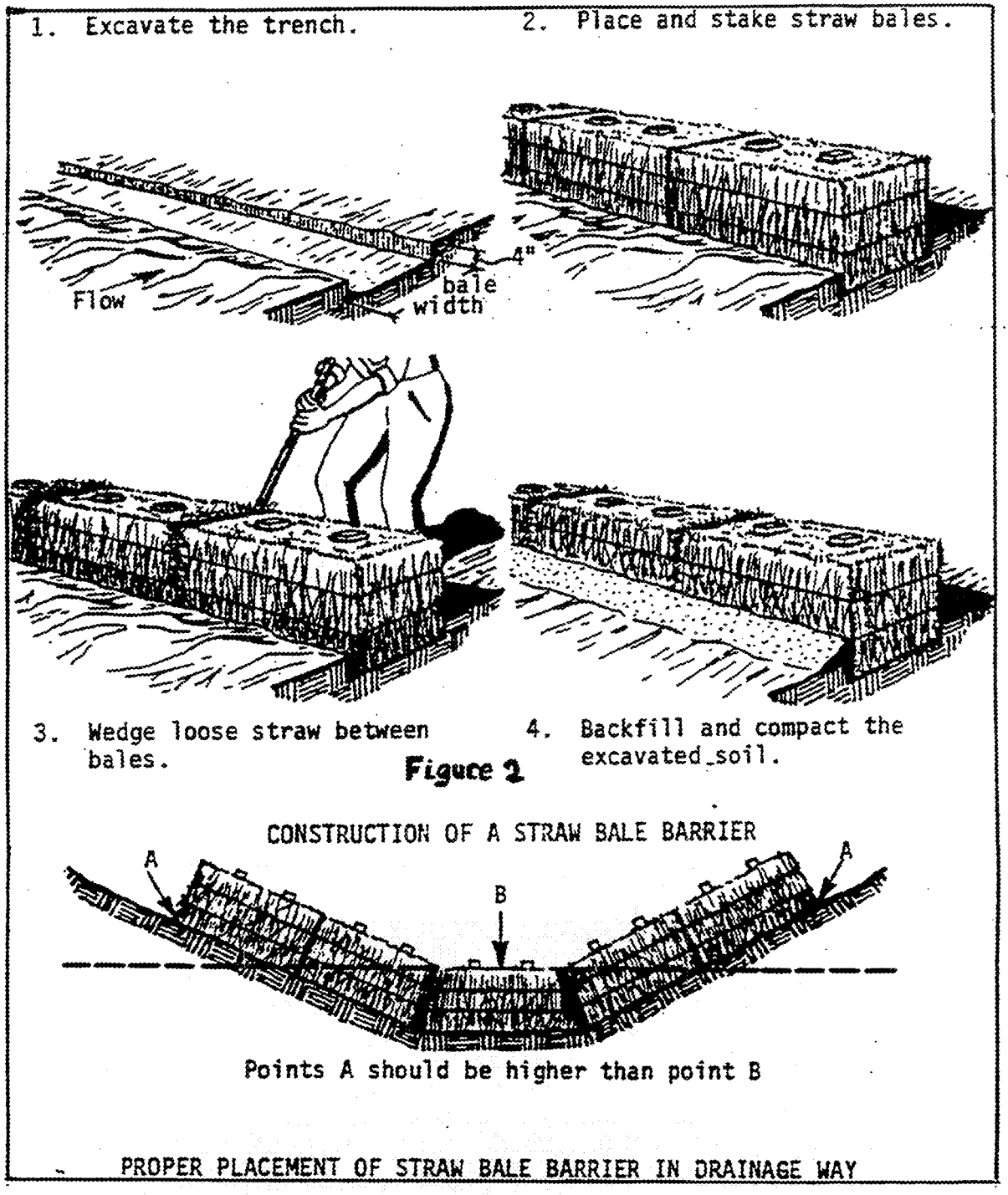



**Figure 2**

CONSTRUCTION OF A STRAW BALE BARRIER




Points A should be higher than point B

PROPER PLACEMENT OF STRAW BALE BARRIER IN DRAINAGE WAY

Source: Installation of Straw and Fabric Filter Barriers for Sediment Control. Sherwood and Wyant

**Figure 3**

TECHNICAL STANDARD AND SPECIFICATIONS

## Silt Fence (SF)

### Definition

A temporary barrier to trap sediment that consists of a filter fabric stretched between supporting posts, with the bottom entrenched in the soil. There are two types. The Silt Fence is a temporary linear filter barrier constructed of synthetic filter fabric, posts, and, depending upon the strength of the fabric used, wire fence for support. The Filter Barrier is constructed of stakes and burlap or synthetic filter fabric.

### Purposes

1. To intercept and detain small amounts of sediment from disturbed areas during construction operations to prevent sediment from leaving the site and damaging streams or entering sinkholes.

2. Where the size of the drainage area is no more than 1/4 acre per 100 feet of silt fence length; the maximum slope length behind the barrier is 100 feet; and the maximum gradient behind the barrier is 50 percent (2:1).

3. In minor swales or ditch lines where the maximum contributing drainage area is no greater than 2 acres.

4. Under no circumstances should silt fences be constructed in live streams or in swales in ditch lines where flows are likely to exceed 1 cubic foot per second (cfs). See Design Criteria for further clarification.

### Planning Considerations

Laboratory work at the Virginia Highway and Transportation Research Council (VH&TRC) has shown that silt fences can trap a much higher percentage of suspended sediments that can straw bales. Silt fences may be preferable to straw barriers in many cases. While the failure rate of silt fences is lower than that of straw barriers, there have been instances in that silt fences were improperly installed. The installation methods outlined here can improve performance.

**Silt Fence (SF) (Cont'd)**

Filter barriers are inexpensive structures composed of burlap or standard weight synthetic filter fabric stapled to wooden stakes. Flow rates through burlap filter barriers are slightly slower and filtering efficiency is significantly higher than for straw bale barriers (see Table 1).

**Table 1**

**FLOW RATES AND FILTERING EFFICIENCIES OF VARIOUS SEDIMENT FILTER MATERIALS**

| Material | Flow Rate (gal./sq.ft./min.) | Filter Efficiency (%) |
|---|---|---|
| Straw | 5.6 | 67 |
| Burlap (10 oz. fabric) | 2.4 | 84 |
| Synthetic Fabric | 0.3 (Avg.) | 97 (Avg.) |

Source: Virginia Highway and Transportation Research Council

Silt fences composed of a wire support fence and an attached synthetic filter fabric slow the flow rate significantly but have a higher filtering efficiency than burlap. Both woven and non-woven synthetic fabrics are commercially available. The woven fabrics generally display higher strength than the non-woven fabrics. When tested under acid and alkaline water conditions, most of the woven fabrics increase in strength. There is a variety of reactions among the non-woven fabrics. The same is true of testing under extensive ultraviolet radiation. Permeability rates vary regardless of fabric type. While all of the fabrics demonstrate very high filtering efficiencies for sandy sediments, there is considerable variation among both woven and non-woven fabrics when filtering the finer silt and clay particles.

Design Criteria

1. No formal design is required.

2. Filter barriers shall have an expected usable life of 3 months. They are applicable in ditch lines, around drop inlets, and at temporary locations where continuous construction changes the earth contour and runoff characteristics and where low or moderate flows (not exceed 1 cfs) are expected.

**Silt Fence (SF) (Cont'd)**

3. Silt fences, because they have a much lower permeability than burlap filter barriers, have their applicability limited to situations in that only sheet or overland flows are expected. They normally cannot filter the volumes of water generated by channel flows, and many of the fabrics do not have sufficient structural strength to support the weight of water ponded behind the fence line. Their expected usable life is 6 months.

SPECIFICATIONS

The following construction specifications have been adopted from the Virginia Erosion and Sediment Control Handbook.

Materials

1. Synthetic filter fabric shall be a previous sheet of propylene, nylon, polyester or ethylene yarn and shall be certified by the manufacturer or supplier as conforming to the following requirements:

| PHYSICAL PROPERTY | REQUIREMENTS |
|---|---|
| Filtering Efficiency | 75% (min.) |
| Tensile Strength at 20% (max.) Elongation* | Extra Strength-50 lbs./lin. in.(min.)<br>Standard Strength-30 lbs./lin. in. (min.) |
| Flow Rate | 0.3 gal./sq. ft./min. (min.) |

*Requirements reduced by 50 percent after six months of installation.

Synthetic filter fabric shall contain ultraviolet ray inhibitors and stabilizers to provide a minimum of 6 months of expected usable construction life at a temperature range of 0°F to 120°F.

2. Burlap shall be 10-ounce per square yard fabric.

3. Posts for Silt Fences shall be either 4-inch diameter wood or 1.33 pounds per linear foot steel with a minimum length of 5 feet. Steep posts shall have projections for fastening wire to them.

4. Stakes for Filter Barriers shall be 1" x 2" wood (preferred) or equivalent metal with a minimum length of 3 feet.

**Silt Fence (SF) (Cont'd)**

5. Wire fence reinforcement for silt fences using standard strength filter cloth shall be a minimum of 42 inches in height, a minimum of 14 gauge and shall have a minimum mesh spacing of 6 inches.

Filter Barrier: This sediment barrier may be constructed using burlap or standard strength synthetic filter fabric. It is designed for low or moderate flows not exceeding 1 cfs. (See Figure 1.)

1. The height of a filter barrier shall be a minimum of 15 inches and shall not exceed 18 inches.

2. Burlap or standard strength synthetic filter fabric shall be purchased in a continuous roll and cut to the length of the barrier to avoid the use of joints (and thus improved the strength and efficiency of the barrier).

3. The stakes shall be spaced a maximum of 3 feet apart at the barrier location and driven securely into the ground (minimum of 8 inches).

4. A trench shall be excavated approximately 4 inches wide and 4 inches deep along the line of stakes and upslope from the barrier.

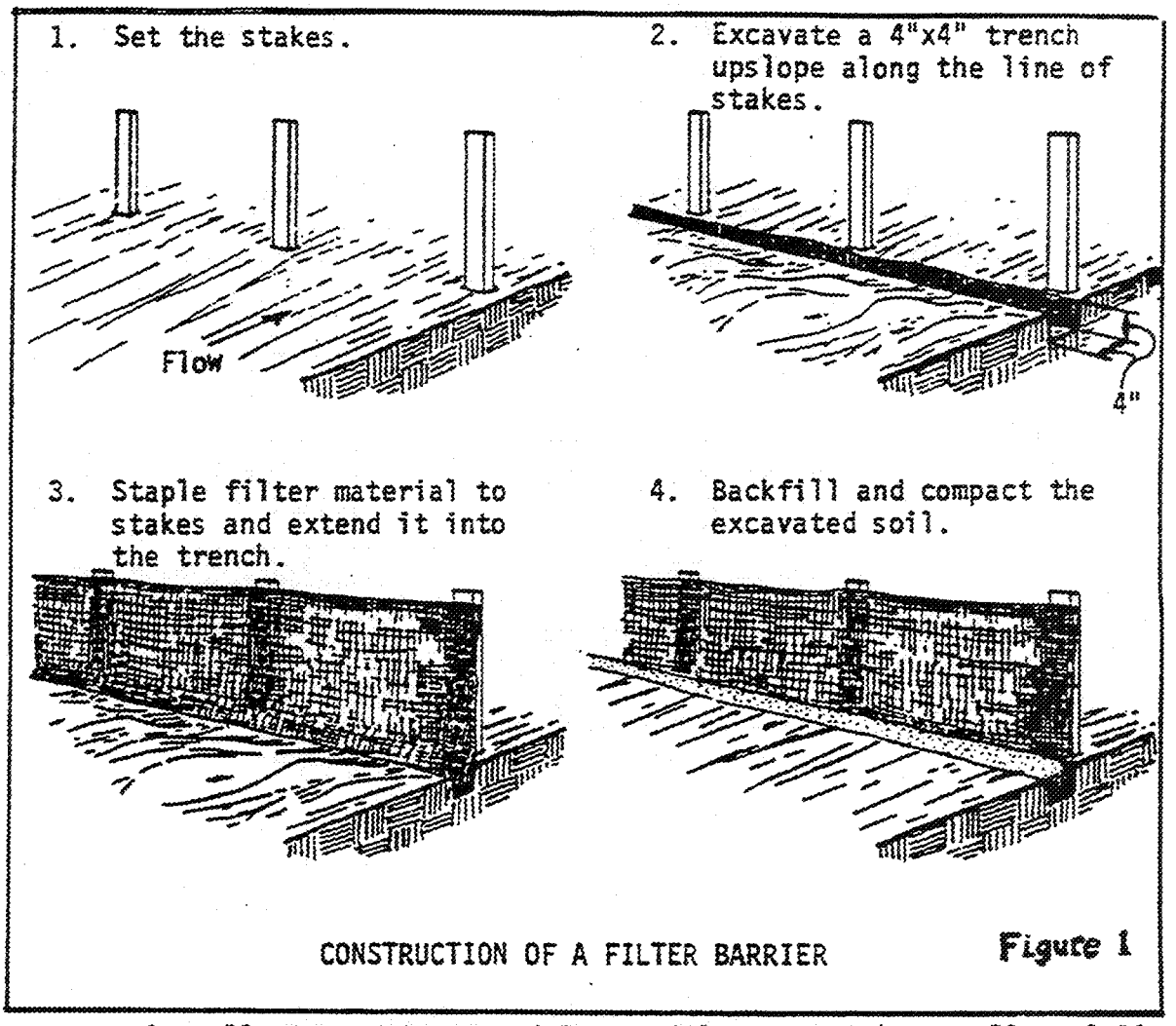
5. The filter material shall be stapled to the wooden stakes, and 8 inches of the fabric shall be extended into the trench. Heavy-duty wire staples at least 1/2-inch long shall be used. Filter material shall not be stapled to existing trees.

6. The trench shall be backfilled, and the soil compacted over the filter material.

7. If a filter barrier is to be constructed across a ditch line or swale, the barrier shall be of sufficient length to eliminate end flow, and the plan configuration shall resemble an arc or horseshoe with the ends oriented upslope (Figure 2).

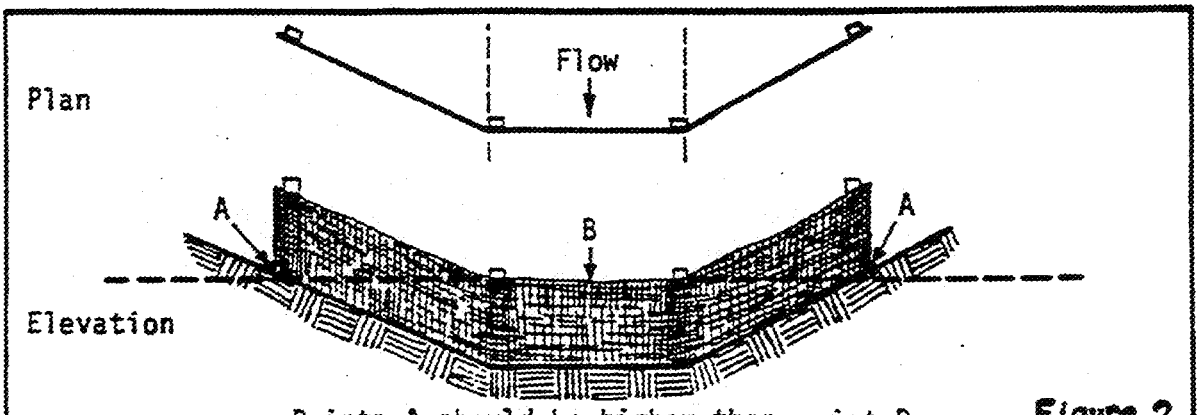
8. Filter barriers shall be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized.

**Silt Fence (SF) (Cont'd)**




CONSTRUCTION OF A FILTER BARRIER **Figure 1**

Source: Installation of Straw and Fabric Filter Barriers for Sediment Control, Sherwood and Wyant Plate 1.06a




Points A should be higher than point B **Figure 2**

PROPER PLACEMENT OF A FILTER BARRIER IN A DRAINAGE WAY

Source: Adapted from Installation of Straw and Fabric Filter Barriers for Sediment Control, Sherwood and Wyant

**Silt Fence (SF) (Cont'd)**

Silt Fence: This sediment barrier utilizes standard-strength or extra-strength synthetic filter fabrics. It is designed for situations in that only sheet or overland flows are expected. See Figure 3.

1. The height of a silt fence shall not exceed 36 inches (higher fences may impound volumes of water sufficient to cause failure of the structure).

2. Posts shall be spaced a maximum of 10 feet apart at the barrier location and driven securely into the ground (minimum of 12 inches). When extra-strength fabric is used without the wire support fence, post spacing shall not exceed 6 feet.

4. A trench shall be excavated approximately 4 inches wide and 4 inches deep along the line of posts and upslope from the barrier.

5. When standard-strength filter fabric is used, a wire mesh support fence shall be fastened securely to the upslope side of the posts using heavy-duty wire staples at least 1 inch long, tie wires or hog rings. The wire shall extend into the trench a minimum of 2 inches and shall not extend more than 36 inches above the original ground surface.

6. The standard-strength filter fabric shall be stapled or wired to the fence, and 8 inches of the fabric shall be extended into the trench. The fabric shall not extend more than 36 inches above the original ground surface. Filter fabric shall not be stapled to existing trees.

7. When extra-strength filter fabric and closer post spacing are used, the wire mesh support fence may be eliminated. In such a case, the filter fabric is stapled or wired directly to the posts with all other provisions of item No. 6 applying.

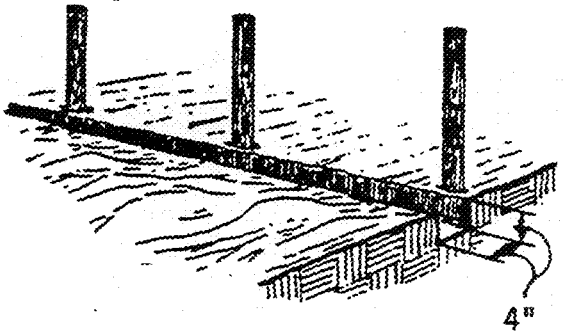
8. The trench shall be backfilled and soil compacted over the filter fabric.

9. Silt fences shall be removed when they have served their useful purpose, but not before the upslope area has been permanently stabilized.

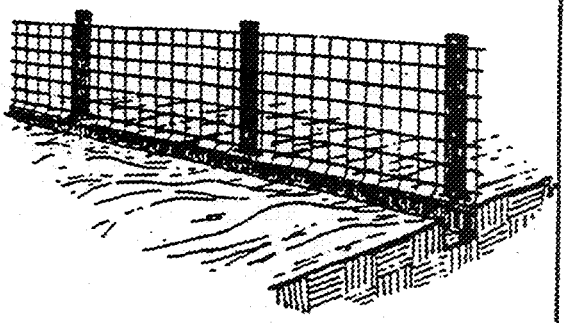
CONSTRUCTION OF A SLIT FENCE

**Silt Fence (SF) (Cont'd)**

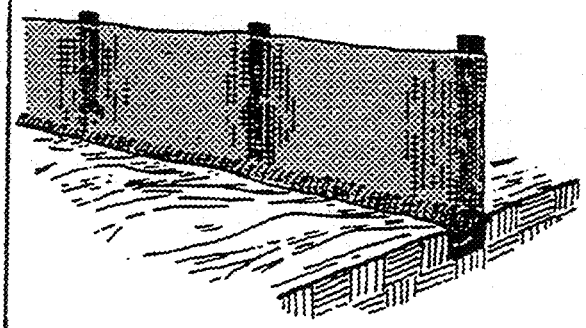
1. Set posts and excavate a 4"x4" trench upslope along the line of posts.



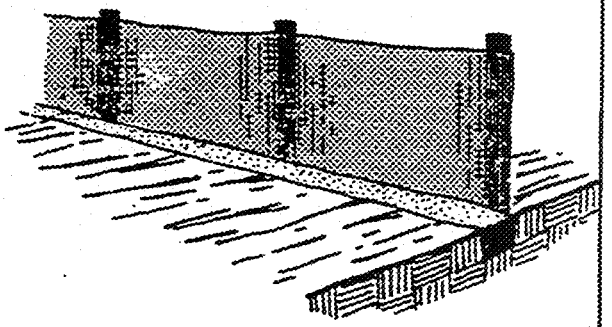

2. Staple wire fencing to the posts.



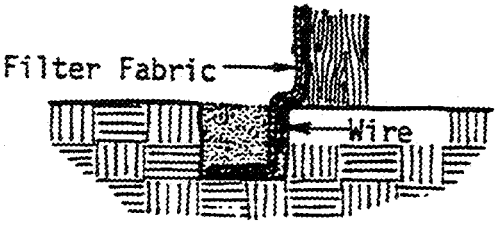
3. Attach the filter fabric to the wire fence and extend it into the trench.



4. Backfill and compact the excavated soil.



Extension of fabric and wire into the trench.




CONSTRUCTION OF A SILT FENCE **Figure 3**

Source: Adapted from Installation of Straw and Fabric Filter Barriers for Sediment Control, Sherwood and Wyant

**Silt Fence (SF) (Cont'd)**

Maintenance

1. Silt fences and filter barriers shall be inspected immediately after each rainfall and at least daily during prolonged rainfall. Any required repairs shall be made immediately.

2. Should the fabric on a silt fence or filter barrier decompose or become ineffective prior to the end of the expected usable life and the barrier is still necessary, the fabric shall be replaced promptly.

3. Sediment deposits should be removed after each storm event. They must be removed when deposits reach approximately one-half the height of the barrier.

4. Any sediment deposits remaining in place after the silt fence or filter barrier is no longer required shall be dressed to conform with the existing grade, prepared and seeded.

TECHNICAL STANDARD AND SPECIFICATIONS

## Storm Drain Inlet Protection (IP)

### Definition

A sediment filter installed around a storm drain drop inlet or curb inlet to reduce sediment discharge.

### Purpose

To prevent sediment from entering storm drainage systems prior to permanent stabilization of the disturbed area.

### Conditions Where Practice Applies

Where storm drain inlets are to be made operational before permanent stabilization of the disturbed drainage area. Different types of structures are applied to different conditions.

### Planning Considerations

Storm sewers that are made operational before their drainage area is stabilized can convey large amounts of sediment to natural drainageways. In case of extreme sediment loading, the storm sewer itself may clog and lose a major portion of its capacity. To avoid these problems, it is necessary to prevent sediment from entering the system at the inlets.

This practice contains several types of inlet filters and traps that have different applications dependent upon site conditions and type of inlet. Other innovative techniques for accomplishing the same purpose are encouraged, but only after careful study of their effectiveness should they be installed.

Note that these various inlet protection devices are for drainage areas of less than one acre. Runoff from large disturbed areas should be routed through a SEDIMENT BASIN.

The best way to prevent sediment from entering the storm sewer system is to stabilize the site as quickly as possible, preventing erosion and stopping sediment at its source.

**Storm Drain Inlet Protection (IP) (Cont'd)**

Design Criteria

1. The drainage area shall be no greater than 1 acre.

2. The inlet protection device shall be constructed in a manner that will facilitate cleanout and disposal of trapped sediment and minimize interference with construction activities.

3. The inlet protection devices shall be constructed in such a manner that any resultant ponding of stormwater will not cause excessive inconvenience or damage to adjacent areas or structures.

4. Design criteria more specific to each particular inlet protection device will be found with that construction specification.

SPECIFICATIONS

1. STRAW BALE DROP INLET STRUCTURE

   a. Bales shall be either wire-bound or string-tied with the bindings oriented around the sides rather than over and under the bales.

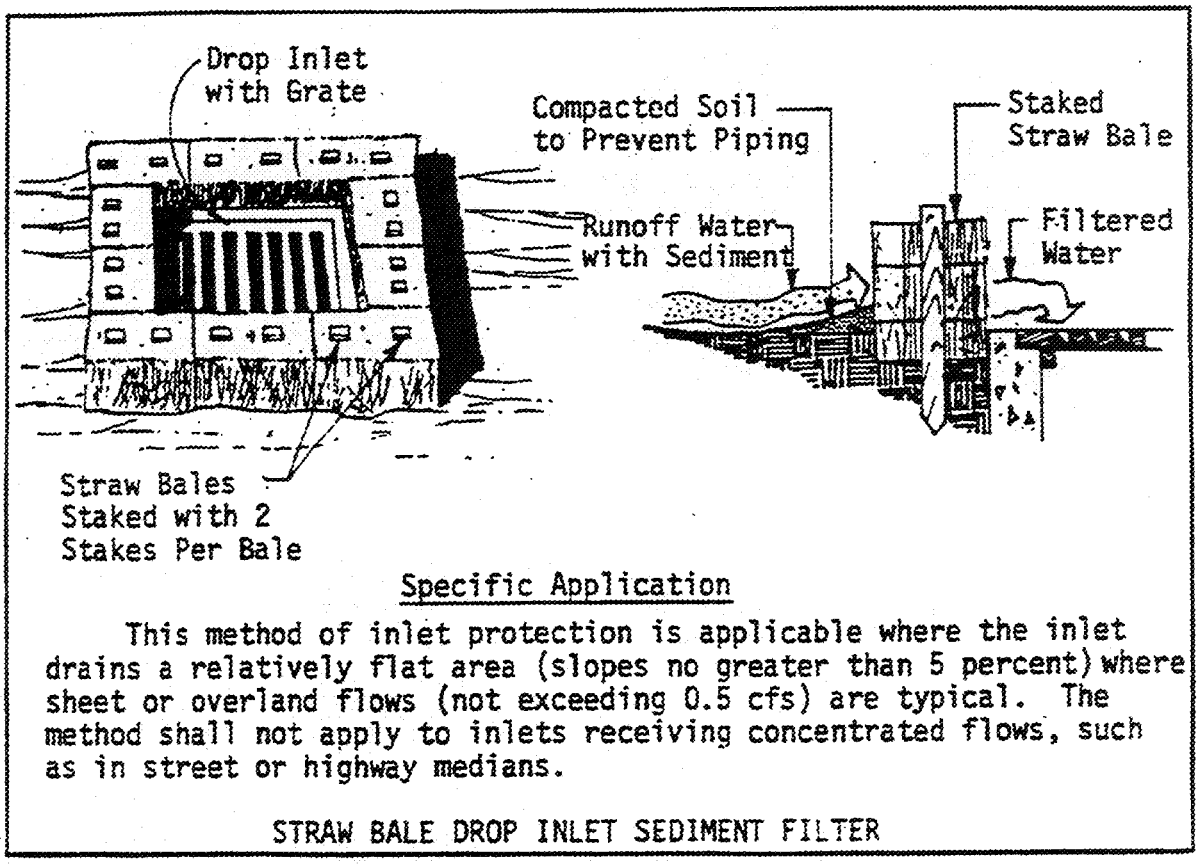
   b. Bales shall be placed lengthwise in a single row surrounding the inlet with the ends of adjacent bales pressed together. (Figure 1)

   c. The filter barrier shall be entrenched and backfilled. A trench shall be excavated around the inlet the width of a bale to a minimum depth of 4 inches. After the bales are staked, the excavated soil shall be backfilled and compacted against the filter barrier.

   d. Each bale shall be securely anchored and held in place by at least two stakes or rebars driven through the bale.

   e. Loose straw shall be wedged between bales to prevent water from entering between bales.

**Storm Drain Inlet Protection (IP) (Cont'd)**




Specific Application

This method of inlet protection is applicable where the inlet drains a relatively flat area (slopes no greater than 5 percent) where sheet or overland flows (not exceeding 0.5 cfs) are typical. The method shall not apply to inlets receiving concentrated flows, such as in street or highway medians.

STRAW BALE DROP INLET SEDIMENT FILTER

Source: Michigan Soil Erosion and Sedimentation Control Guidebook, 1975

**Figure 1**

2. GRAVEL AND WIRE MESH DROP INLET SEDIMENT FILTER

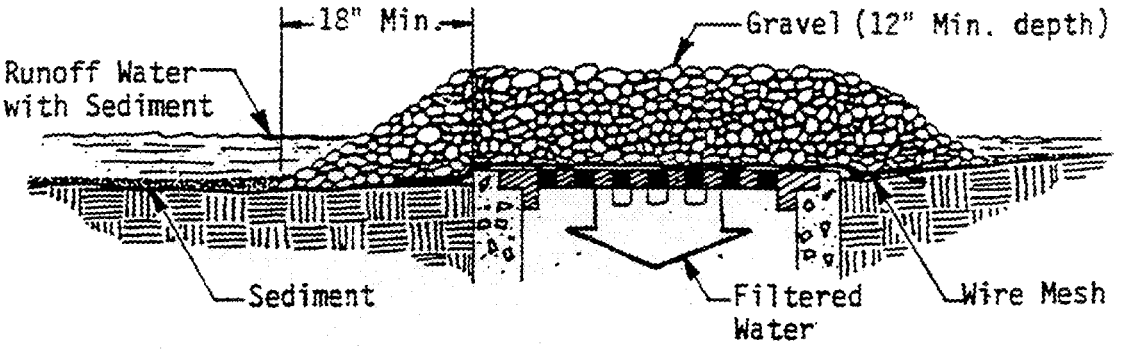
   a. Wire mesh shall be laid over the drop inlet so that the wire extends a minimum of 1 foot beyond each side of the inlet structure. Hardware cloth or comparable wire mesh with 1/2-inch openings shall be used. If more than one strip of mesh is necessary, the strips shall be overlapped.

**Storm Drain Inlet Protection (IP) (Cont'd)**

b. KDOT No. 2 Coarse Aggregate shall be placed over the wire mesh as indicated in Figure 2. The depth of stone shall be at least 12 inches over the entire inlet opening. The stone shall extend beyond the inlet opening at least 18 inches on all sides.

c. If the stone filter becomes clogged with sediment so that it no longer adequately performs its function, the stones must be pulled away from the inlet, cleaned and replaced.

Note: This filtering device has no overflow mechanism, therefore, ponding is likely especially if sediment is not removed regularly. This type of device must never be used where overflow may endanger an exposed fill slope. Consideration should also be given to the possible effects of ponding on traffic movement, nearby structures, working areas, adjacent property, etc.




Specific Application

This method of inlet protection is applicable where heavy concentrated flows are expected, but not where ponding around the structure might cause excessive inconvenience or damage to adjacent structures and unprotected areas.

GRAVEL AND WIRE MESH DROP INLET SEDIMENT FILTER

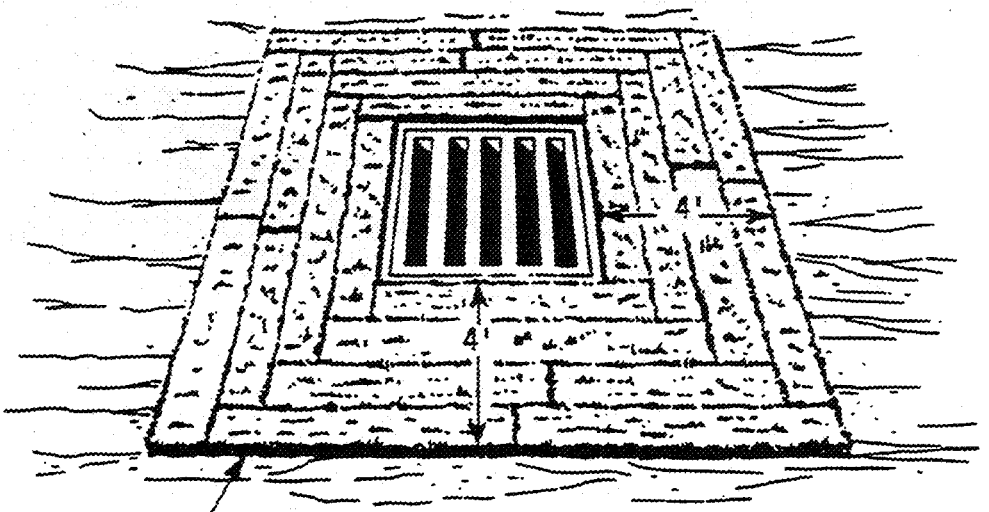
**Figure 2**

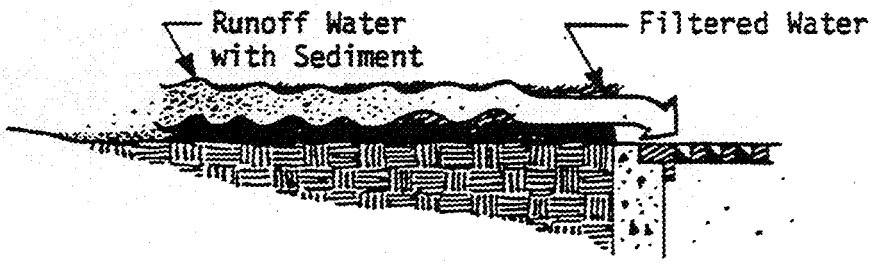
**Storm Drain Inlet Protection (IP) (Cont'd)**

3. SOD DROP INLET SEDIMENT FILTER

a. Soil shall be prepared and sod installed according to the specification in Critical Area Planting - Sodding.

b. Sod shall be placed to form a turf mat covering the soil for distance of 4 feet from each side of the inlet structure, as illustrated in Figure 3.




Specific Application

This method of inlet protection is applicable only at the time of permanent seeding, to protect the inlet from sediment and mulch materials until permanent vegetation has become established.

SOD DROP INLET SEDIMENT FILTER

**Figure 3**

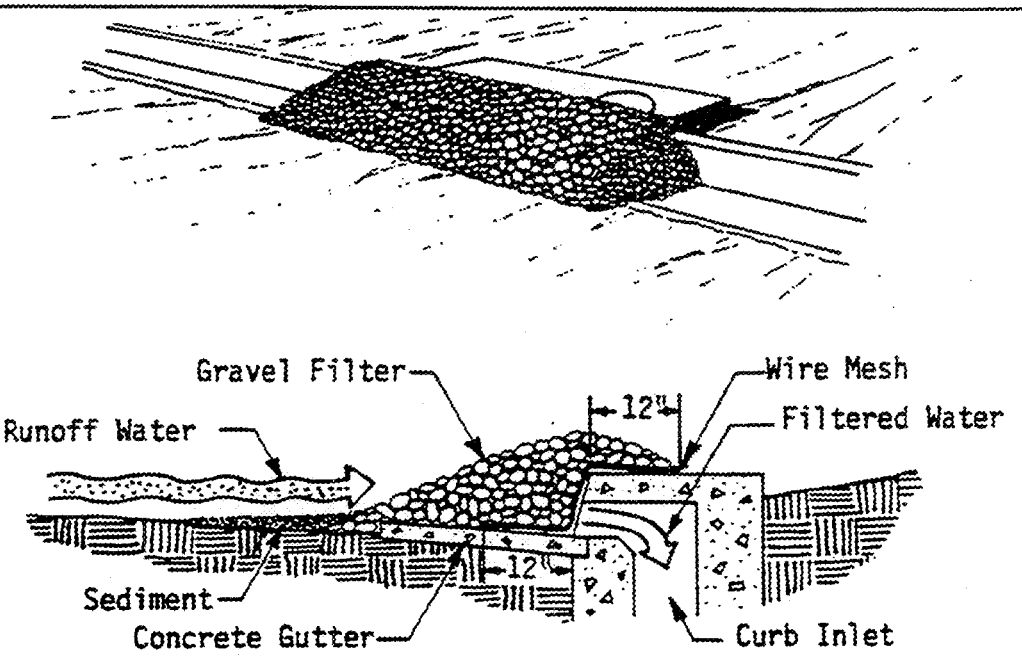
**Storm Drain Inlet Protection (IP) (Cont'd)**

4. GRAVEL CURB INLET SEDIMENT FILTER

a. Hardware cloth or comparable wire mesh with 1/2-inch openings shall be placed over the curb inlet opening so that at least 12 inches of wire extends across the inlet cover and at least 12 inches of wire extends across the concrete gutter from the inlet opening, as illustrated in Figure 4.

b. Stone shall be piled against the wire so as to anchor it against the gutter and inlet cover and to cover the inlet opening completely. KDOT No. 2 Coarse Aggregate shall be used.

c. If the stone filter becomes clogged with sediment so that it no longer adequately performs its function, the stone must be pulled away from the block, cleaned and replaced.




Specific Application

This method of inlet protection is applicable at curb inlets where ponding in front of the structure is not likely to cause inconvenience or damage to adjacent structures and unprotected areas.

GRAVEL CURB INLET SEDIMENT FILTER

**Figure 4**

**Storm Drain Inlet Protection (IP) (Cont'd)**

5. BLOCK AND GRAVEL CURB INLET SEDIMENT FILTER

   a. Two concrete blocks shall be placed on their sides abutting the curb at either side of the inlet opening.

   b. A 2-inch by 4-inch stud shall be cut and placed through the outer holes of each spacer block to help keep the front blocks in place.

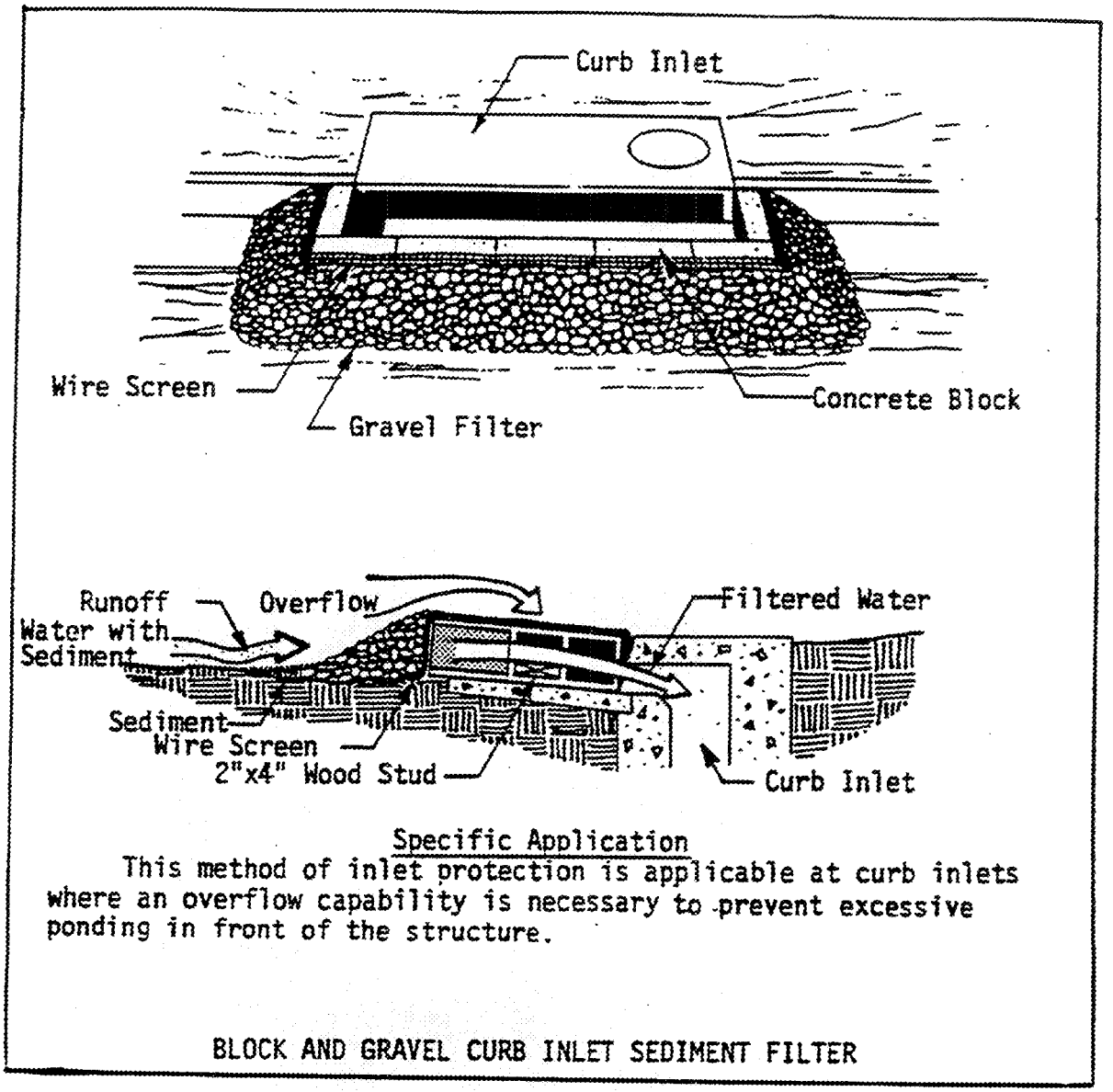
   c. Concrete blocks shall be placed on their sides across the front of the inlet and abutting the spacer blocks as illustrated in Figure 5.

   d. Wire mesh shall be placed over the outside vertical face (webbing) of the concrete blocks to prevent stone from being washed through the holes in the blocks. Chicken wire or hardware cloth with 1/2-inch openings shall be used.

   e. KDOT No. 2 Coarse Aggregate shall be piled against the wire to the top of the barrier as shown in Figure 5.

   f. If the stone filter becomes clogged with sediment so that it no longer adequately performs its function, the stone must be pulled away from the blocks, cleaned and replaced.

**Storm Drain Inlet Protection (IP) (Cont'd)**




Specific Application

This method of inlet protection is applicable at curb inlets where an overflow capability is necessary to prevent excessive ponding in front of the structure.

BLOCK AND GRAVEL CURB INLET SEDIMENT FILTER

**Figure 5**

6. BLOCK AND GRAVEL DROP INLET SEDIMENT FILTER

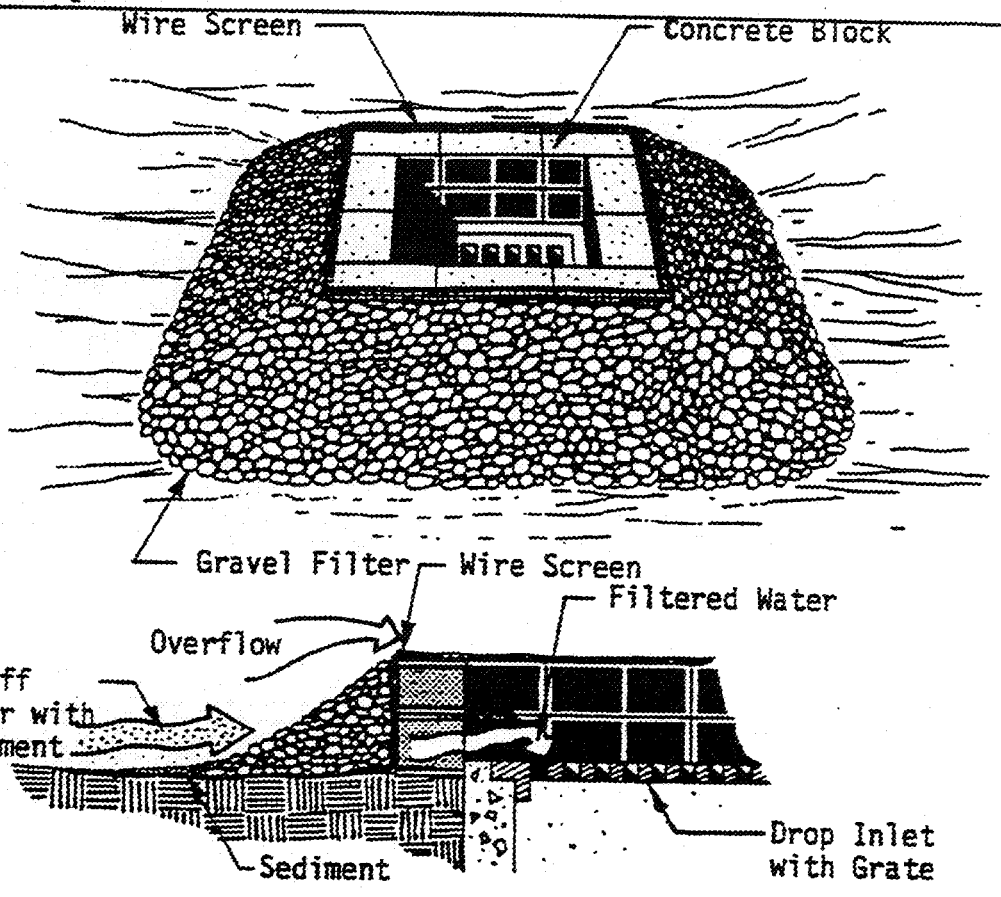
   a. Place concrete blocks lengthwise on their sides in a single row around the perimeter of the inlet, with the ends of adjacent blocks abutting. The height of the barrier can be varied, depending on design needs, by stacking combinations of 4-inch, 8-inch and 12-inch wide blocks. The barrier of blocks shall be at least 12 inches high and no greater than 24 inches high.

**Storm Drain Inlet Protection (IP) (Cont'd)**

b. Wire mesh shall be placed over the outside vertical face (webbing) of the concrete blocks to prevent stone from being washed through the holes in the blocks. Hardware cloth or comparable wire mesh with 1/2-inch openings shall be used.

c. Stone shall be piled against the wire to the top of the block barrier, as shown in Figure 6. KDOT No. 2 Coarse Aggregate shall be used.

d. If the stone filter becomes clogged with sediment so that it no longer adequately performs its function, the stone must be pulled away from the blocks, cleaned and replaced.




Specific Application

This method of inlet protection is applicable where heavy flows are expected and where an overflow capacity is necessary to prevent excessive ponding around the structure.

BLOCK AND GRAVEL DROP INLET SEDIMENT FILTER

**Figure 6**

**Storm Drain Inlet Protection (IP) (Cont'd)**

Maintenance

1. The structure shall be inspected after each rain, and repairs made as needed.

2. Sediment shall be remove and the trap restored to its original dimensions when the sediment has accumulated to one-half the design depth of the trap. Removed sediment shall be deposited in a suitable area and in such a manner that it will not erode.

3. Structures shall be removed and the area stabilized when the remaining drainage area has been properly stabilized.

WATER MANAGEMENT, EROSION AND
SEDIMENT CONTROL FOR CONSTRUCTION AREAS

TECHNICAL STANDARD AND SPECIFICATIONS

**Filter Strip (FS)**

## Definition

A strip of area of vegetation for removing sediment and related pollutants from runoff.

## Purpose

To remove sediment and other pollutants from runoff by infiltration, deposition, infiltration, absorption, and decomposition, thereby reducing pollution and protecting the environment.

## Conditions Where the Practice Applies

This practice applies to land undergoing development where filter strips are needed to reduce sediment damage to adjacent property, streams or sinkholes. Filter strips shall not only be used to remove sediment from overland (sheet) flow. Filters are not effective in removing sediment from concentrated flows.

## Planning Considerations

Vegetative filters cannot be expected to remove all sediment nor adequately protect adjacent areas from sediment damage when used alone. Vegetative filter should only be considered as one component of the erosion and sediment control system. The effectiveness of filter strips can vary considerably depending on the type of vegetation, the height and density of the vegetation, season of the year, type of sediment (sand, silt, or clay), the size of the area exposed, and the topography of the exposed area.

Vegetative filters, if not existing, should be planned and established prior to disturbing the land that will produce the sediment.

There are no precise design criteria that will guarantee a particular level of sediment removal.

## SPECIFICATIONS

Minimum strip width shall be 15 feet, and maximum strip width shall be 100 feet or wider if determined by on-site evaluation. Where streams or sinkholes are being protected, these widths will be on each side of the stream. The required width will be determined in the field depending on the severity of the sedimentation problem and the physical characteristics of the site.

**Filter Strip (FS) (Cont'd)**

Existing grass or grass/legume mixtures, if well established, should be used as filter strips. When establishing new seeding, considerations should be given to wildlife needs and soil conditions on the site. The following chart provides a list of alternative grass and grass/legume mixtures.

**Table 1**
**SEEDING MIXTURE AND SITE SUITABILITY CHART**

| Seeding Mixture[1] | Rate Lbs./Acre[2] | SOIL SUITABILITY Wet | Well Drained[3] |
|---|---|---|---|
| 1. Alfalfa[4] | 10 | | * |
| or Red Clover | 10 | | |
| Plus | | | |
| Timothy | 4 | | |
| or Orchardgrass | 6 | | |
| or Bromegrass | 6 | | |
| 2. Ladino Clover[4] | 1/2 | * | * |
| Plus | | | |
| Timothy | 4 | | |
| or Orchardgrass | 6 | | |
| or Bromegrass | 8 | | |
| 3. Tall Fescue | 40 | * | * |
| 4. Reed Canarygrass | 15 | * | |
| Plus | | | |
| Tall Fescue | 10 | | |

[1]/ All permanent seeding shall be completed between April 1 and May 15, or August 1 and September 15. If an alternate seeding time is necessary, follow the specifications contained in Temporary Seeding.

[2]/ Includes sites that are excessively wet only a portion of the growing season.

[3]/ Includes sites that are well drained with tile; also naturally well drained and droughty sites.

[4]/ Mixtures 1 and 2 are more desirable for wildlife habitat.

Follow the specification contained in Critical Area Planting - Permanent seeding for seedbed preparation, fertilizing and mulching.

**Filter Strip (FS) (Cont'd)**

Plans should show the location, width, and length of filter strips. The type of vegetation and specifications for soil preparation and seeding should be included. If existing vegetation is to be used, directions should be provided as to how it will be protected or improved.

Maintenance

Maintenance for vegetative filter strips is the same as that recommended for any vegetation. A healthy growth of vegetation can be best maintained by limited fertilization if needed, removing sediment when the filter becomes clogged, and by preventing construction traffic from driving upon or across filter strips.

WATER MANAGEMENT, EROSION AND
SEDIMENT CONTROL FOR CONSTRUCTION AREAS

TECHNICAL STANDARD AND SPECIFICATIONS

**Vegetative Streambank Stabilization (VSS)**

STANDARD

Definition

The use of vegetation to stabilize streambanks.

Purpose

To protect the banks of creeks, streams, and rivers that are, or may be, affected by excess runoff from construction activities. This practice does not apply to shoreline conditions.

Conditions Where Practice Applies

Along the banks of creeks, streams, and rivers that are, or may be, affected by excess runoff from construction activities. This practice does not apply to shoreline conditions.

Planning Considerations

1. The protective measures planned shall be compatible with the adjacent land use and the improvements that will be carried out by others.

2. The selection of vegetation to be established shall be based on the soil type, land use, flooding periods, and stream velocity.

3. Where necessary, structural measures shall be planned along with the vegetative measures to stabilize the streambanks.

4. Special attention shall be given to maintaining or improving habitat for fish and wildlife.

5. Where a good seedbed can be prepared and on smaller streams, grasses may be used alone to stabilize the banks. On the more difficult sites, streambank shrubs with grasses should be considered.

6. All requirements of state law and permit requirements of local, state, and federal agencies must be met.

**Vegetative Streambank Stabilization (VSS) (Cont'd)**

SPECFIFICATIONS

A. Site Preparation

1. The trees and brush that will affect the growth of desirable vegetation may need to be reduced on a limited basis.

2. Prior to seeding or planting, remove only fallen trees, stumps, and other debris that may force streamflow into the streambank.

3. Where necessary the streambank side slope shall be cut back to 2:1 slope or flatter and remove overhanging bank edges.

4. The seedbed shall be roughened with a rake or similar tool and fertilized with 1,000 lbs. per acre of 15-15-15 or equivalent (24 lbs./1,000 square feet).

B. Plant Selection and Establishment

1. Grasses

a. Tall Fescue (Fungus Free) Seed at a rate of 50 lbs. per acre (1 lb./1,000 sq. ft.) and mulch with straw at a rate of 2 tons per acre (90 lbs. per 1,000 sq. ft.). Establish between March 15 and September 30. Cover the seed 1/4-1/2-inch by rake or similar tool.

Notes: This is the most widely used and best adapted grass for streambank seedings. It has good tolerance to wet soils and flooding. It is also well adapted to well-drained soils.

b. Reed Canarygrass (Phalaris arundinacae) plus Tall Fescue-- Seed the Reed Canarygrass at a rate of 15 lbs. per acre (1/3 lb./1,000 sq. ft.), plus 10 lbs. per acre (1/4 lb./1,000 sq. ft.) of Tall Fescue. Mulch with straw at a rate of 2 tons per acre (90 lbs./1,000 sq. ft.). This mixture should only be seeded from March 1 to May 15, or August 1 to September 30. Cover the seed 1/4-1/2-inch by raking or similar tool.

**Vegetative Streambank Stabilization (VSS) (Cont'd)**

Notes: Previous mixture is adaptable to soils that are very wet, as well as well-drained soil conditions. Reed Canarygrass can withstand extended periods of flooding. It is excellent for erosion control. Reed Canarygrass can also be established by sod strips, using rhizomes, or freshly cut culms. The local Soil Conservation Service office can provide the specific details required to use one of the alternative establishment methods.

2. Shrubs - Such as either "Streamco" Purpleosier Willow (Salix purpura) or "Bankers" Willow (Salix cottelii).

The "Streamco" is the larger of the two willow shrub species and can grow to a height of 10-18 feet, but does not usually reach that height on streambanks. "Bankers" Willow is smaller with a height of 6-7 feet. Use either one-year-old nursery-grown rooted cuttings or fresh cuttings for establishment. The fresh cuttings shall be 3/8- inch to 1/2-inch thick and 12 inches to 18 inches long. Fresh cuttings must be kept cool and moist until planted. (Other species may be considered upon recommendation.)

Plant the rooted stock the same depth as planted in the nursery. The stock should be planted in a hole large enough to accommodate the root system when well spread.

Plant the fresh cuttings vertically in the bank with 1-2 inches of wood protruding above the ground surface. Tamp adequately to provide complete contact between the cutting and the soil.

Plant in early spring while the rooted stock and fresh cuttings are dormant.

Temporary Stabilization During Woody Plant Establishment

The newly planted willows for the first 2 years do not effectively provide streambank protection. It is recommended that Tall Fescue and/or other listed species be seeded before or just after the willow plantings to provide the initial streambank protection. Follow those seeding rates. (See Temporary Seeding Specifications.)

**Vegetative Streambank Stabilization (VSS) (Cont'd)**

C. Streambank Berm Seedings

Where feasible and needed, the streambank berms can be seeded to wildlife mixture of grasses and legumes. The following are mixtures that can be used:

| | | |
|---|---|---|
| 1. | Alfalfa | 5#/acre |
| | Yellow Sweet Clover | 2#/acre |
| | Ladino Clover | 0.5#/acre |
| | Orchardgrass | 3#/acre |
| 2. | Alfalfa | 4#/acre |
| | Red Clover | 3#/acre |
| | Bromegrass | 5#/acre |
| | Timothy | 2#/acre |
| | Orchardgrass | 2#/acre |
| 3. | Alfalfa | 5#/acre |
| | Yellow Sweet Clover | 2#/acre |
| | Ladino Clover | 0.5#/acre |
| | Bromegrass | 5#/acre |
| 4. | Alfalfa | 10#/acre |
| | Bromegrass | 6-8#/acre |
| 5. | Bromegrass | 2-4#/acre |
| | Timothy | 4-6#/acre |
| | Orchardgrass | 4-6#/acre |
| 6. | Alfalfa | 5#/acre |
| | Yellow Sweet Clover | 2#/acre |
| | Ladino Clover | 0.5#/acre |
| | Orchardgrass | 4#/acre |
| 7. | Ladino Clover | 1#/acre |
| | Orchardgrass | 4#/acre |
| | Red Clover | 4#/acre |
| | Alsike Clover | 4#/acre |

Where streambank berms need to be seeded to a lawn mixture, the following are mixtures that can be used:

| | | |
|---|---|---|
| 1. | Dwarf (turf-type) Fescue | 150#/acre |
| | plus Kentucky Bluegrass | 20#/acre |
| 2. | Kentucky Bluegrass | 90#/acre |
| | plus Red Fescue | 45#/acre |

**Vegetative Streambank Stabilization (VSS) (Cont'd)**

Seedbed preparation for the berm seeding shall consist of an application of 1,000 lb./acre of 15-15-15 fertilizer or equivalent worked into the upper 2-4 inches of the soil surface. Broadcast and cover the seed or drill the seed followed by straw mulching at 2 tons/acre. Anchor the straw using a crimper, asphalt emulsion, or wetting. Seed between March 1 and September 30.

Maintenance

Streambanks are always vulnerable to new damage. Repairs are needed periodically. Banks should be checked after every high-water event. Gaps in the vegetative cover should be fixed at once with new plants and mulched if necessary. Fresh cuttings from other plants on the bank can be used, or they can be taken from mother-stock plantings if they are available. Undesirable trees that become established on the bank should be removed.

WATER MANAGEMENT, EROSION AND
SEDIMENT CONTROL FOR CONSTRUCTION AREAS

TECHNICAL STANDARD AND SPECIFICATIONS

**Structural Streambank Stabilization (SSS)**

## Definition

Methods of stabilizing the banks of live streams with permanent structural measures.

## Purpose

To protect streambanks from the erosive forces of moving water.

## Conditions Where Practice Applies

Stream channel erosion problems vary widely in type and scale, and there are many different structural stabilization techniques that have been employed with varying degrees of effectiveness. The purpose of this specification is merely to point out some of the practices that are available and to establish some broad guidelines for their selection and design. Such structures should be planned and designed in advance by an engineer with experience in this field. Many of the practices referenced here involve the use of manufactured products and should be designed and installed in accordance with manufacturer's specification.

Before selecting a structural stabilization technique, the designer should carefully evaluate the possibility of using vegetative stabilization to achieve the desired protection. Vegetative techniques are generally less costly and more compatible with natural stream characteristics.

## General Guidelines

Since each reach of channel requiring protection is unique, measures for streambank protection should be installed according to a plan and adapted to the specific site. Designs should be developed according to the following principles:

1. Protective measures to be applied shall be compatible with improvements planned or being carried out by others.

**Structural Streambank Stabilization (SSS) (Cont'd)**

2. The bottom scour should be controlled, by either natural or artificial means, before any permanent type of bank protection can be considered feasible. This is not necessary if the protection can be safely and economically constructed to a depth well below the anticipated lowest depth of bottom scour.

3. Streambank protection should be started and ended at a stabilized or controlled point on the stream.

4. Changes in channel alignment shall be made only after an evaluation of the effect upon land use, interdependent waste water systems, hydraulic characteristics and existing structure.

5. Special attention should be given to maintaining and improving habitat for fish and wildlife.

6. Structural measures must be effective for the design flow and be capable of withstanding greater flows without serious damage.

7. All requirements of state law and permit requirements of local, state, and federal agencies must be met.

SPECIFICATIONS

Streambank Protection Measures

Riprap - heavy angular stone placed or dumped onto the streambank to provide armor protection against erosion. Riprap shall be designed and installed according to the practice entitled RIPRAP.

Gabions - these rectangular rock-filled wire baskets are previous, semi-flexible building blocks that can be used to armor the bed and/or banks of channels or to divert flow away from eroding channel sections. Gabions should be designed and installed in accordance with manufacturer's standards and specifications (Figure 1).

Deflectors (groins or jetties) - structural barriers that project into the stream to divert flow away from eroding streambank sections.

Reinforced Concrete - may be used to armor eroding sections of the streambank by constructing retaining walls or bulkheads. Positive drainage behind these structures must be provided. Reinforced concrete may also be used as a channel lining.

**Structural Streambank Stabilization (SSS) (Cont'd)**

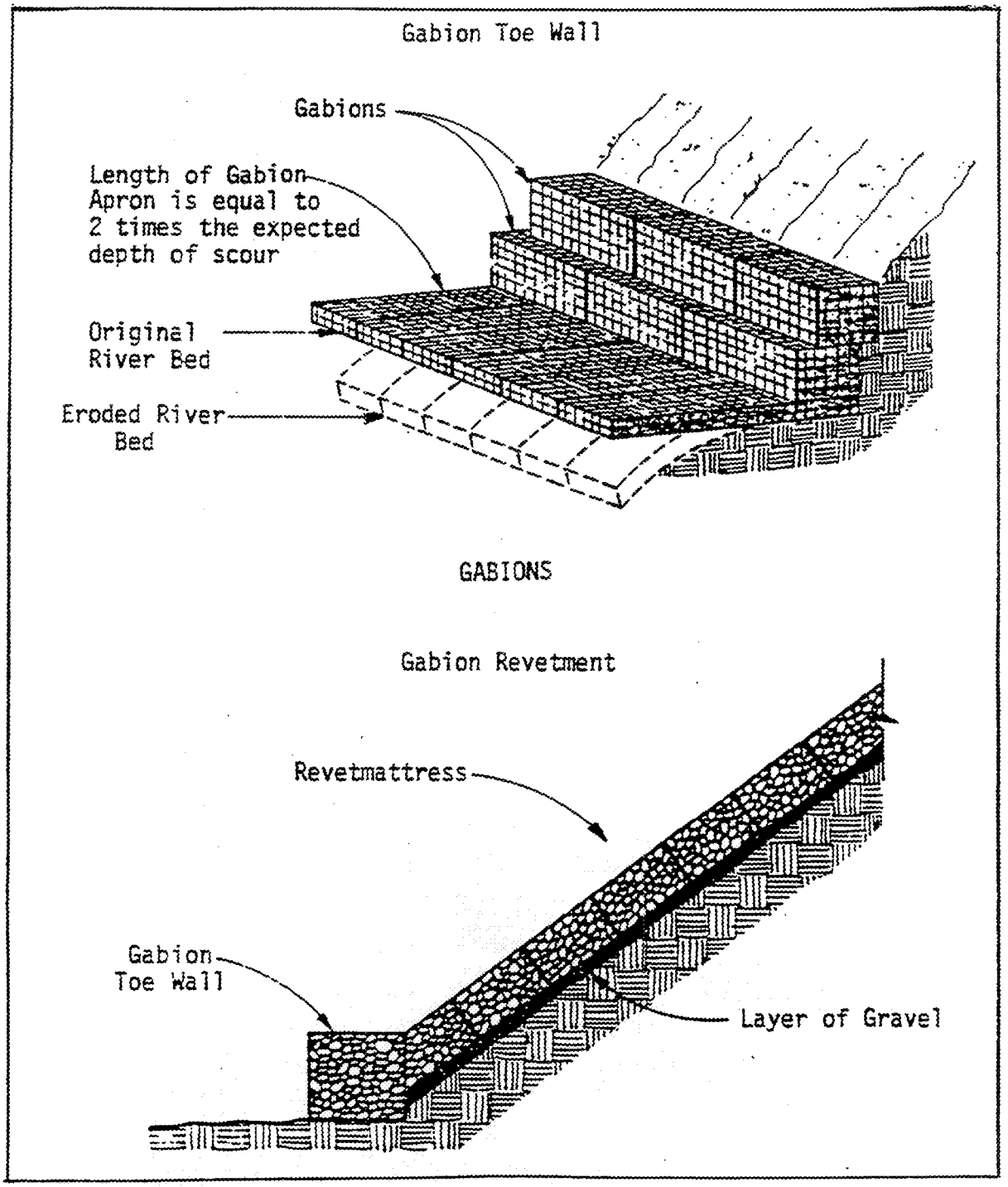
Log Cribbing - a retaining structure built of logs to protect streambanks from erosion. Place logs single, parallel to shoreline and cover.

Grid Pavers - modular concrete units with interspersed void areas that can be used to armor the streambank while maintaining porosity and allowing the establishment of vegetation. These structures may be obtained in precast blocks or mats, or they may be formed and poured in place. Design and installation should be in accordance with manufacturer's instructions (Figure 2).

Maintenance

All structures should be maintained in an "as built" condition. Structural damage caused by storm events should be repaired as soon as possible to prevent further damage to the structure or erosion of the streambank.

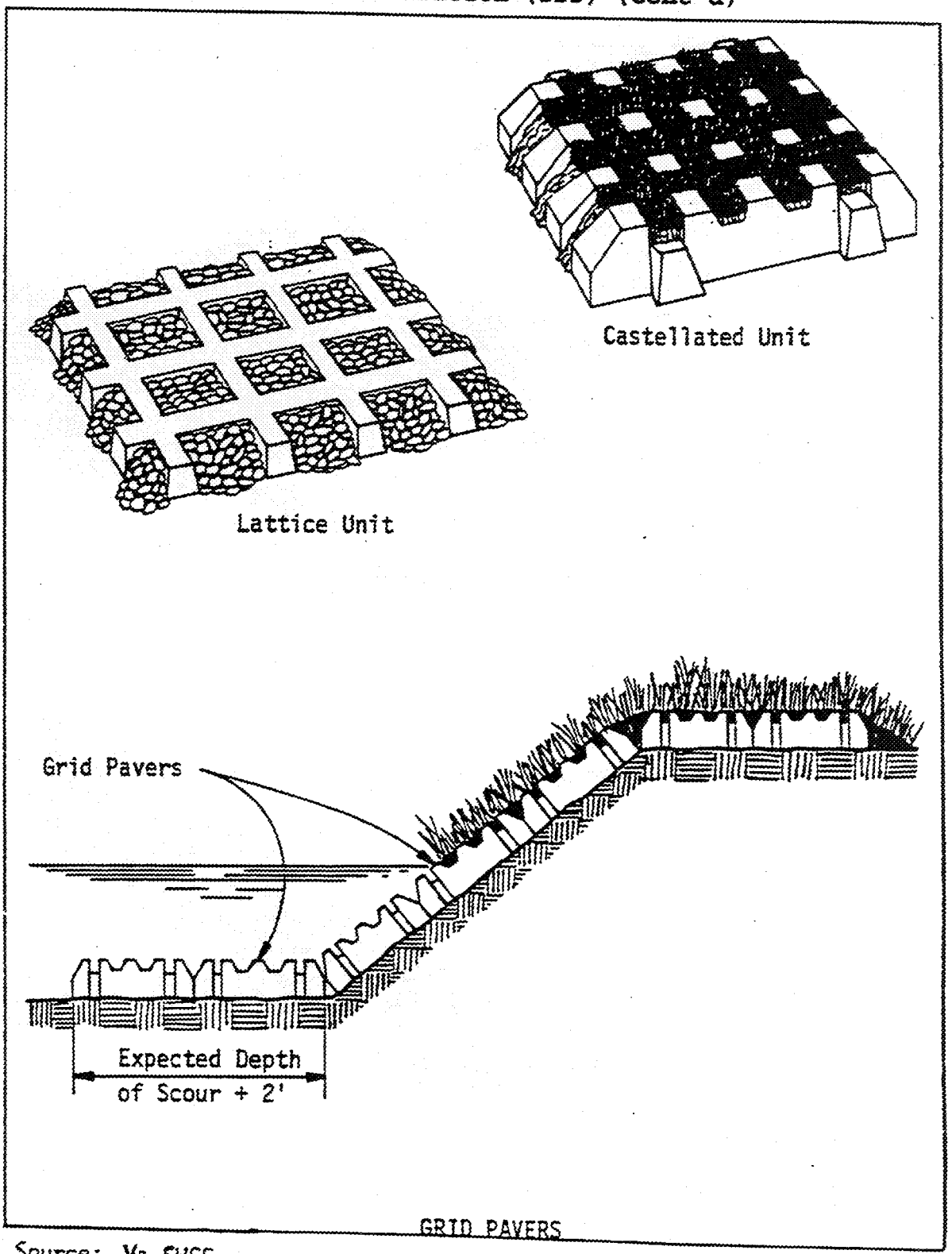
**Structural Streambank Stabilization (SSS) (Cont'd)**




Source: Adapted from product literature of Bekaert Gabions

**Figure 1**

**Structural Streambank Stabilization (SSS) (Cont'd)**




GRID PAVERS

Source: Va SWCC

**Figure 2**

TECHNICAL STANDARD AND SPECIFICATIONS

## Temporary Stream Crossing (TSC)

### Definition

A temporary structural span installed across a flowing watercourse for use by construction traffic. Structures may include bridges, round pipes, or pipe arches.

### Purpose

1. To provide a means for construction traffic to cross flowing streams without damaging the channel or banks.

2. To keep sediment generated by construction traffic out of the stream.

### Conditions Where Practice Applies

Generally applicable to flowing streams with drainage areas less than 1 square mile. Structures that must handle flow from larger drainage areas should be designed as permanent structures by a professional engineer.

### Planning Considerations

Temporary stream crossings are necessary to prevent construction vehicles from damaging streambanks and continually tracking sediment and other pollutants into the flow regime. However, these structures are also undesirable in that they represent a channel constriction that can cause flow backups or washouts during periods of high flow. For this reason, the temporary nature of stream crossings is stressed. They should be planned to be in service for the shortest practical period of time and to be removed as soon as their function is completed.

The specifications contained in this practice pertain primarily to flow capacity and resistance to washout of the structure. From a safety and utility standpoint, the designer must also be sure that the span is capable of withstanding the expected loads from heavy construction equipment that will cross the structure. The designer must also be aware that such structures are subject to the rules and regulations of the U.S. Army Corps of Engineers for in-stream modifications (404 permits) and the Kentucky Natural Resources and Environmental Protection Cabinet, Division of Water (401 certification).

**Temporary Stream Crossing (TSC) (Cont'd)**

Design Criteria

The following design criteria has been adapted from the Virginia Erosion and Sediment Control Handbook.

1. The structure shall be large enough to convey the peak flow expected from a 2-year, 24 hour frequency storm without appreciable altering the stream flow characteristics. The structure may be a span or culvert. (Multiple culverts may be used in place of one large culvert if they have the equivalent capacity of the larger one. The minimum-sized culvert that may be used is 18 inches.)

2. Where culverts are installed, compacted soil will be used to form the crossing. The depth of soil cover over the culvert shall be equal to one-half the diameter of the culvert or 12 inches, thatever is greater. To protect the sides of the fill from erosion, riprap shall be used and designed in accordance with the practice entitled RIPRAP.

3. The length of the culvert shall be adequate to extend the full width of the crossing, including side slopes.

4. The slope of the culvert shall be at least 0.25 inch per foot.

5. The top of the compacted fill shall be covered with six inches of KDOT No. 57 stone.

6. The approaches to the structure shall consist of stone pads meeting the following specifications:

    a. Stone--KDOT No. 57
    b. Minimum thickness--6 inches
    c. Minimum width equal to the width of the structure
    d. Minimum approach length--25 feet

SPECIFICATIONS

1. Clearing and excavation of the streambed and banks shall be kept to a minimum.

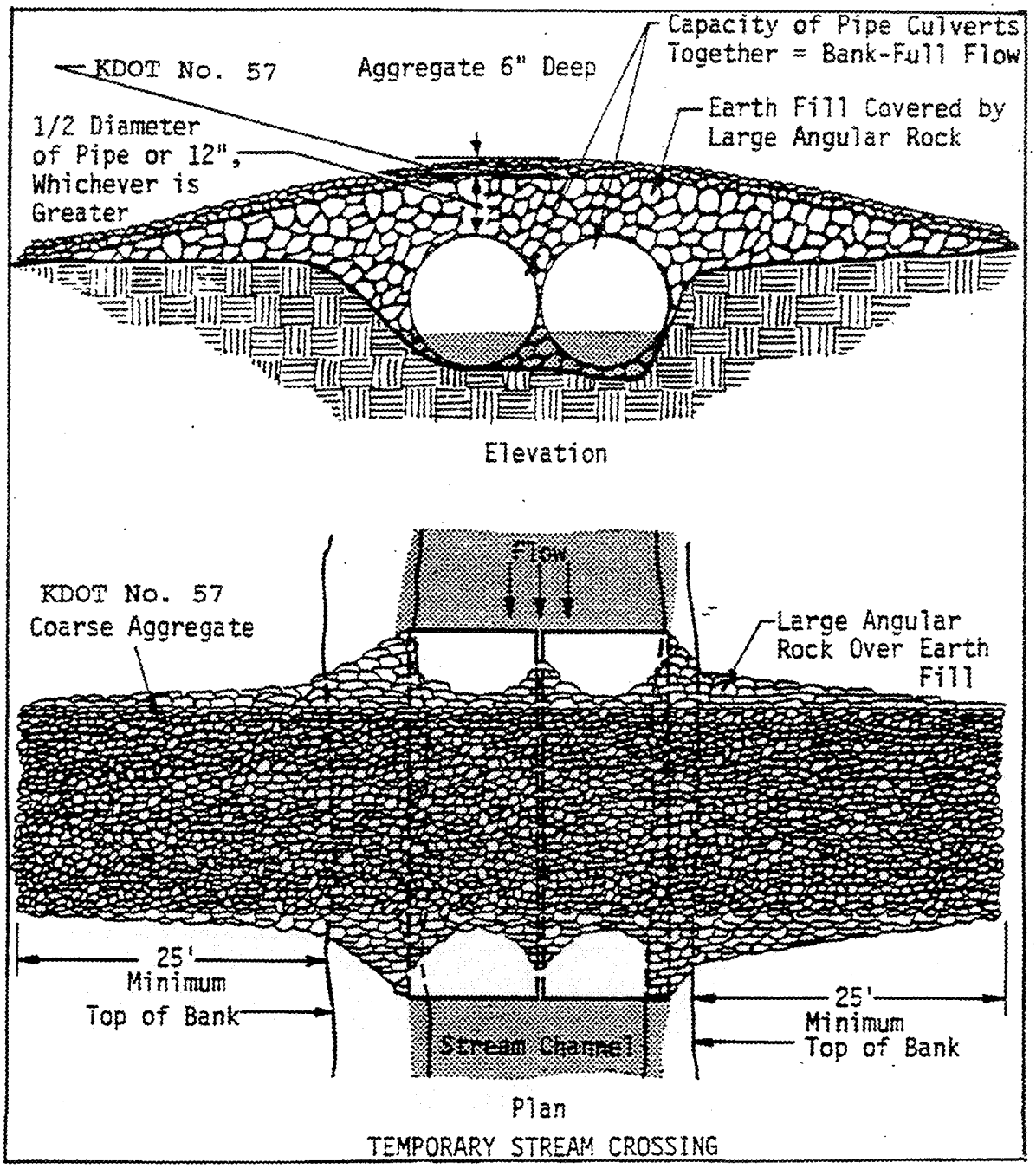
2. The structure shall be removed as soon as it is no longer necessary for project construction.

3. Upon removal of the structure, the stream shall immediately be reshaped to its original cross section and properly stabilized.

**Temporary Stream Crossing (TSC) (Cont'd)**

Maintenance

The structure shall be inspected after every rainfall and at least once a week, whether it has rained or not, and all damages repaired immediately.




Source: Va SWCC

**Figure 1**